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Art. XVI.—*Teratological Notes: Part 2.*

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(With Plates XI., XII., XIII.).

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The first part of this series was devoted to seedlings. The present contribution is intended to record some instances of aberration of stem, branch, and fruit. For part 3 is reserved a number of cases of foliar abnormality.

Root.

One abnormal root arrangement was near Heidelberg, on the Yarra, where erosion of the river bank caused an exposure of the roots of two small red-gum trees (*Eucalyptus rostrata*). The trees, nearly equal in size, stood 8 feet apart, and were connected by a simple cable root. The cable was dead and much waterworn, its thickness varying irregularly between 2 and 3 inches. Seen from a canoe in a swift current by Mr. R. A. Keble and myself, it was not conveniently situated for photography or for further investigation than to note that there was no suture indicative of fusion. It is possible that one of the two trees was originally a sucker of the other, but of faster subsequent development, and that the continuation of the supporting root had disappeared without leaving superficial evidence of its having existed. The specimen was carried away during further erosion, but there is another—though not so good—at a bend of the river just above Heidelberg.

Stem.

Malposition.—Peculiarities in form and posture of the stem may be seen where, on the northern edge of the plains to the north and north-west of Melbourne, the eucalypts (*E. rostrata*) have yielded to the pressure of the prevailing winds of their youth. The southward leaning of about 60 per cent. of these large trees can be seen from the Whittlesea railway. They are bent from the vertical, near the base, through angles varying up to 65 degrees, and at times are so much curved and arched that the large branches have fractured in contact with the ground, and occasionally from this semi-recumbent position send up shoots, or adjust existing shoots, the

inclination of which does not suggest that the winds prevail now in the same force.

Adhesion.—Near Turritable Creek, Macedon, there is a composite growth, comprising two species—*Eucalyptus obliqua* and *E. viminalis*—which by mutual pressure are fused at the base, but have the remainder of their stems and their branches free. In stem and canopy the small Messmate (*E. obliqua*) is dominant, its partner being dwarfed, low-branched, and distorted. The presence of two species would have escaped notice but for the cortical distinction.

Torsion.—Spiral growth, betrayed by the bark, affects many forest trees. When present in species of the cortical group Rhytophloiae, it is conspicuous at all seasons, but, in those of the Leiophloiae, more conspicuous during certain stages of decortication. In the messmates, stringybarks, and silvertop-ironbark, the spiralling of the bark is frequently noticeable, and often, in a mixed forest, *E. sieberiana* may be singled out from amongst others of somewhat similar appearance, because of this spiral tendency. Of the Leiophloiae there is a tree between Lara and the You Yangs, which, when alive, had dark and light slashes of colour markings, irregular in detail, but of general spiral trend. The picture shown is from a photograph taken after the death of the tree, when ring-barked, the conspicuous, irregularly sinuous and spiral lines indicating the openings in the bark due to shrinkage.

Bifurcation.—Early forking of lowland trees is not uncommon. The tendency of trees (of lofty habit in the highland glens) to dwarf, and approach the shrub form in exposed lowland situations may be seen in *Eucalyptus viminalis* and *E. obliqua*, while in the silurian hills of Kerry, *E. obliqua* and *E. amygdalina* have many stems arising from near the ground, and resembling "mallee" or shrubby Eucalypts. There is a young *E. rostrata*, symmetrically bifurcated, in Richmond Park, Melbourne. The giant Eucalypt *E. regnans*, occasionally forks early in sheltered localities.

Fasciation.—This phenomenon is, according to Blaringhem and Worsdell, the result not of the union of younger organs which remain coherent for a longer or shorter period, but from the absence of individualization of the cells or tissue into independent buds. Worsdell attributes fasciation to congenital impulse, and not to post-genital union of parts, as supposed by Masters and others, and regards it as the first sign of partition of a single shoot.

In the practically aphyllous Exocarpi and Casuarinae fasciation may be found. *E. cupressiformis* exhibits the formation frequently

in the terminal branches. I have seen it in *E. spartea* only once, and the specimen of *E. gracilis* (exhibited) is the only case of fasciation of this sub-desert species known to me or to the many travellers in the Mallee region, whom I consulted. The specimen was sent by Mr. Poole, Staff Surveyor, as a novelty from North-West Victoria. The shrub is affected from within a few inches of the ground upwards, until, towards the summit, multiple forking takes place, and this is accompanied by curling, an almost regular concomitant of fasciation. Small branches arising from any part of this fasciated axis are normal in character.

A fasciated branch of *Casuarina stricta* was exhibited[1] at a meeting of the Field Naturalists' Club by the Assistant Director of the Botanic Gardens, Melbourne.

The great length to which fasciation may affect an axis is seen in the specimen of Tecoma (exhibited), which is flattened through four feet of its length.

Branch.

Cohesion of Branches.—Cohesion of contemporary or other branches of one plant occurs in *Eucalyptus rostrata*, the crooked branching of which affords more opportunities than are obtained in any other species. The tree figured (Plate XI.) is growing in the Kiewa Valley, near Tanganbalanga. There is fusion of branches in several places, the primary cause being the premature forking of the stem at 4 feet from the ground. This early bifurcation of the axis allowed insufficient room for subsequent branching of the great divisions, which are 2 feet thick; so the secondary branches came into contact, and, by mutual pressure, have fused. At one place the smaller branch became so overgrown by the bark of the larger as to produce the appearance of penetration. Another example of branch fusion was described by a member of the National Herbarium staff, and figured in the "Victorian Naturalist."[2]

Torsion of Branches.—This is a rare occurrence where uncultivated plants are concerned. Plate XI., fig. 2, shows two of the many affected twigs of one tree—*Casuarina stricta*—near Melbourne. In general appearance the tree was as healthy as its neighbours, none of which was similarly torsive, but it and others succumbed to the ravages of borers. Both vegetative and reproductive twigs were affected, the spiral being short in proportion to the total

1 Pitcher, Vict. Nat., xxix., Jan., 1913.
2 Audas, Vict. Nat., xxvii. (1911) p. 207.

length—from a tenth to a twentieth part. In many twigs the spiral growth was at or near the base, in some others about midway, and in a few the terminal node was the abnormal one. In Casuarina the staminiferous twigs have the stamens at the nodes of the apical end only, but in the abnormal twigs a spiral staminiferous node was in one case succeeded by several nodes of purely vegetative character. Staminiferous spirals were usually terminal, and the anthers and their pollen grains were morphologically good; so, too, were the stamens borne at terminal nodes of twigs affected by torsion nearer the base. The method of growth of these spirals appears to be as follows:—Instead of the usual production of whorls of leaves, which in the matured branchlets might reach an inch or more in length—laterally connate and decurrent except for the scale-like free end which forms the cup whence springs the succeeding shoot—there is, usually, in the abnormal branchlets a bursting of the cup-like circlet of scales, and an oblique emergence of a laterally-developing spiral band, forming a tortuous structure with laterally connate members, each of which is terminated by a pointed, scale-like leaf-end, similar to those of a normal whorl. The leaves laterally connate in such a laterally winding spiral are one-fourth the length of normal branchlets, and in number may be regarded as indefinite, there being 45, 51, and 59 respectively in three of the longer spirals which I closely examined; and other spirals were longer. The spirals wound indifferently to the right or to the left in respective twigs. The stamens in the case of a staminiferous spiral appeared as a continuous fringe at the overlapping edge of the imbricated tunic so formed. The number of leaf-ends in a whorl in *C. stricta* is not constant, but is from 9 to 12.

In many aquatic or marsh plants torsion of vegetative shoots which are normally cylindrical and hollow is a not uncommon occurrence. *Heleocharis sphacelata* is one that I have frequently noticed, and in this case the discoid septae become ellipsoid. The cylindrical shoot becomes flattened, and twists in a more or less easy torsion while keeping perfectly straight (the twist being that of an auger rather than that of a corkscrew), while, in other plants, solid, angular shoots may twist through an inch or two of the apical end, the twist being a compromise between a zig-zag (in one plane) and a corkscrew spiral. This is exemplified by the shoots of *Xanthorrhoea minor* (Plate XIII., fig. 5), the leaves, straight for about 12 inches, having the terminal inch torsive.

Heterotropy (reversed direction of growth of a branch and branchlets of a hybrid eucalypt. Plate XII.).

On the way from Stawell to the Grampians, and near Brigg's Creek, on Rose's Gap road, there is, in a paddock lately occupied by Mr. Wills as a bee farm and range, a tree which seemed to be a hybrid (*Eucalyptus hemiphloia* × *E. melliodora*), with foliage, fruit and bark satisfying the requirements of the former, and with buds distinctly nearer the latter species. Both species grew in the district, but with no *E. melliodora* lately in the immediate neighbourhood. *E. melliodora* (Yellow Box) sometimes—frequently in the silurian country near Alexandra, etc.—assumes a drooping habit like *Salix babylonica*, or the Weeping Elm; many trees may be found aggregated in a locality or scattered amongst those of more or less erect habit, but *E. hemiphloia* avoids this weeping habit entirely, so far as my experience goes. In the particular tree under notice, there is a fork in the stem at only a few feet from the ground, and at a height at about 30 feet an offshoot from the main limb bears a branch which terminates abruptly, but sends back at an angle of 40 degrees or so a smaller branch, which, by reason of its slenderness and the weight of foliage subsequently produced below, hangs vertically. After 10 feet of growth earthwards, during which there were several abortive attempts to retain downward-growing twigs, one lateral branch at an acute angle grew downwards until at about 6 feet it sent a branchlet upwards at an acute angle, and this persisted, and bore good foliage, and the downward growth ceased and withered back to an abrupt end, where the dead portion snapped off. Meanwhile the leader pursued its downward course, the stumps of dead and missing twigs indicating the production of several downward branches—leaving a space of about 16 feet of denuded axis below, while three branches have persisted, and from these latter I collected the bloom, buds and fruit by which I recognized the probability of the parentage being as above mentioned. At the abrupt, broken, and dead termination of this 30-feet-long pendent leader a final branch, directed upwards at an acute angle, bore abundant foliage. The whole, swinging from 30 feet above, swayed and gently gyrated in the light breeze, but during a gale must be badly used at times. The drooping habit of one branch and some offshoots reminded me of weeping forms of *E. melliodora*, and if the tree is, as I believe, a hybrid, it may be that the tendencies to an erect—and also to a drooping—habit were present at the same time during growth, with the heterotropic result shown in

the drawing. The leader, instead of tapering downwards, thickens considerably before—or because of—upward branching. Evidence of many attempts to produce persistent geotropic offshoots is seen in the numerous "die-backs," some of which are shown in the plate (XII., figs. 1-7).

Adventitious Shoots.—These are commonly seen in many species of eucalypts, but they are generally vegetative growths caused by injury to the old stem or branch. In those species, which have juvenile and adult foliage distinct, e.g., *globulus*, *goniocalyx*, *elaeophora*, *viminalis*, *rubida*, *stuartiana*, and many others, the adventitious shoots exhibit the characteristic phyllotaxis and axial nature of juvenile shoots, but the case now brought under notice (Pl. XIII., 4) is of unusual interest in that these shoots, taken from the fork of a cultivated Blue Gum (*E. globulus*) at Stawell, has an abundance of buds, flowers, and fruit in the axils of the opposite, sessile, dorsiventral leaves. Springing from the same affected spot, and well shaded by the canopy of mature foliage, were several other similar shoots. The tree was generally in bloom or bearing young buds or fruits, but in no case did any of the normal branches carry more fruit than these "reversionary" shoots. In the Stawell district, I found trees of *E. elaeophora* in which there were buds, flowers, or fruit in the axils of dorsiventral, opposite, sessile leaves, and also where the leaves were opposite, but petiolate, and mostly on drooping branches at a height of 12 feet or so. (Pl. XIII., 1.)

Eucalyptus dives[1] is known to bloom while in the sucker stage, and it is not uncommon to find, in the axils of both opposite, sessile leaves of the lower branches and petiolate alternate leaves higher on the sapling, flowers or fruit in various stages of development; but the limit of precocity seems to have been approached, if not reached, in a sucker shoot (exhibited) taken from the base, at the ground, of a sapling of *E. dives*, near Healesville. This shoot, with sessile, opposite, dorsiventral leaves has a well-developed umbel in an axil at the second node, six inches from the ground, and again at 12 inches, the total length of the shoot being 18 inches. In *Eucalyptus rostrata*, usually a large tree and one that does not bloom in the sapling stage, we may find in exceptional circumstances a similar precocity. The species grows straight-stemmed and robust on damp flats, subject to periodical inundation, but, as the photograph (exhibited) shows, may also thrive on rocky ground well above

1 At maturity this species is a forest tree in good localities.

the limit of stream influence, while yet obtaining large size, the rooting being good. On the Hawthorn bank of the Barker's Road tram cutting, near the Yarra, there are two shrubby specimens of *E. rostrata*, which bloom generously every year; the leaves, flowers, and fruit are typical, but the buds often bear conical opercula. These lowly specimens, growing as they are on the outcropping silurian strata, which dips at an angle of about 70 degrees, must have their roots confined to the bed planes. Yet on comparatively unfriendly ground, with roots unusually confined, and the general habit altered, they produce abundant fruit, some of which may be on branches only two feet from the ground. One of the plants is 12 feet, and the other 6 feet, high.

Fruit.

Bifurcated Peduncles.—Bifurcated peduncles, or, alternatively, double umbels are rare. The specimens shown (Pl. XIII., 1) is from a branch of *E. elaeophora* collected at Stawell. There were many adventitious shoots on the upper branches of the tree whence the specimen was taken, and it appears to be in transition stage, the phyllotaxis being that of the juvenile plant, near the base, and up to the middle, while towards the apex the leaves become alternate and petiolate, though lacking the length of those of adult foliage. Near the middle of the twig are a pair of opposite leaves, with petioles much longer than even those of the normally petiolate leaves of the species, and in the axil of each there is a double umbel. Although the reduced number of fruits suggests bifurcation of the peduncle of a single umbel, I prefer to regard it as a case of proliferation, as the umbels in normal axils on this tree were in many places sparsely fruited, and in each of the affected axils there was one peduncle longer than the other. Normally there should be in the axils of the alternate petiolate leaves, simple pedunculate umbels, each of which should have six fruits. It will be observed that these two long-petiolate leaves are abnormally narrow; they are narrower than any I have seen on a tree of this species. I have seen double umbels, also in *E. goniocalyx*, *E. elaeophora*, and *E. obliqua*.

Connation.—Lateral connation of fruits or even syncarpy might reasonably be expected in some species of eucalypts, owing to there being many almost stalkless fruits forming the umbel, or where short-stalked fruits are few but large, as in *E. globulus*, etc., but the occurrence is rare. Irregularity of shape through mutual

pressure may sometimes be seen. Sustained pressure is at times avoided by the sacrifice of one or more members of the umbel. In a quantity of fruit of *E. cordata*, procured from Tasmania by the Conservator of Forests, Mr. H. Mackay, I found fully 25 per cent. of the umbels—which usually are trimerous in series monoplane or approaching thereto—affected by lateral connation. In these coherent fruits the rims were circular or nearly so. The cohesion was not necessarily due to mutual pressure, but probably congenital, as in some cases there were only two fruits occupying the axial place of three. (Pl. XIII., 3.)

Precocious Fruiting Amongst Resting Buds.—This was observed in two umbels of *Eucalyptus eugenioides*. It is the habit of many eucalypts to rest from flowering during a season, and to bloom in alternate years. In some species the bud-to-seed period is a few months—in others one, two, or (rarely) perhaps three years. *E. rostrata* is prone to biennial fruiting; in some species a season of vigorous reproduction is sometimes followed by two years' rest. This phenomenon (the "on" and the "off" year) is watched carefully by apiarists as of ecomonic importance in their anticipation of, and arrangements for, "honey-flow." Other eucalypts, as the winter-flowering *E. leucorylon*, *E. siderorylon*, etc., bloom yearly; and others, climatically affected, are irregular, but in most cases the fruit does not mature until the second year. So that, as a rule, a fruitful eucalypt bears either young fruit which will ripen next year, or old fruit of last year's flowering, or may have the old fruits present during the early development of young fruits of the present season. The habit of *E. eugenioides* is not known to me, but of four twigs collected between Bruthen and Orbost one bore two umbels of abnormal development. Of these one comprised seven young flowers and one old fruit, while the other consisted of six buds, one newly expanded flower, and two fully matured fruits. In view of the resting condition of the contemporary buds at the time when these fruits began to develop in the previous year, this may be regarded as a case of precocity. (Pl. XIII., 2.) Seen also in *E. obliqua*.

Delayed Dehiscence.—Species of both *Callistemon*[1] and *Melaleuca* retain their ripened seeds for years. The specimen of *C. lanceolatus* (exhibited) accounts for six years' fruit, and seeds from the first four of the series germinated when the capsules were opened by artificial heating.

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1 Cf. Ewart, Annals of Botany, vol. xxi., 1907, 135.

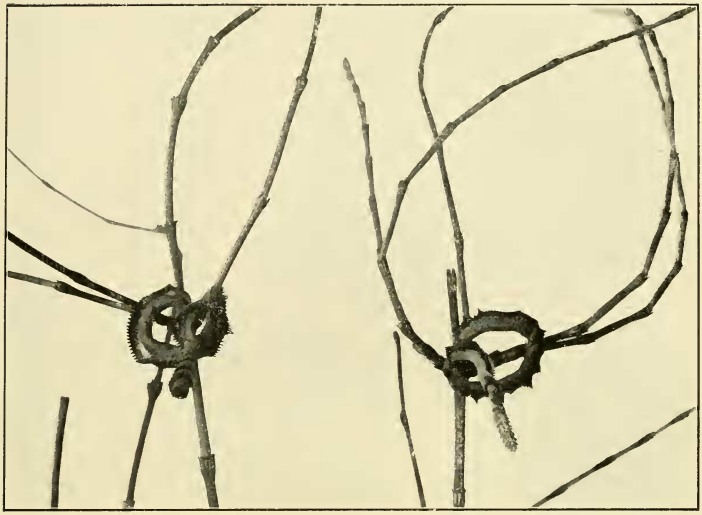

Fig. 2

Fig. 1